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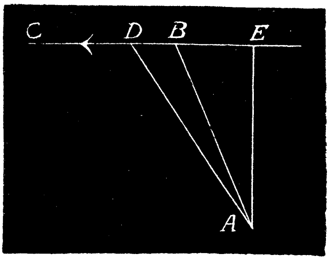

$AE'=AB\cos x$, or $b=8a\cos x$, $a=\dfrac{b}{8\cos x}$. $CD=10a$.

$DE=b\tan\theta$, $BE=b\tan x$. $y=\dfrac{10b}{8\cos x}+b\tan\theta-b\tan x$. $\dfrac{dy}{dx}=\dfrac{5b\sin x}{4\cos^2 x}-b\sec^2 x$.

Let $\dfrac{dy}{dx}=0$, whence $\sin\theta=\dfrac{4}{5}$, $\theta=53^\circ\,8'$.

The equation shows that b and θ do not affect the result.

Also solved by *Professors PHILBRICK, WHITAKER, ZERR*, and the *PROPOSER*.

14. Proposed by J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

Right triangles are inscribed in a circle whose center $=(a, b)$, and radius$=c$. If one of the legs passes through a fixed point, prove that $c^2(x^2+y^2)=(a^2+b^2-c^2-ax-by)^2$ is the curve to which the other leg is always tangent; the fixed point being the origin of the co-ordinates.

Solution by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

Let $lx+my=1$....(1) be the chord of the circle whose envelope is to be found. Then $y=\dfrac{m}{l}x$....(2) is the side of the triangle passing through the fixed point, and $(x-a)^2+(y-b)^2=c^2$....(3) is the equation to the circle.

(1) and (2) intersect in $x'=\dfrac{l}{l^2+m^2}$, $y'=\dfrac{m}{l^2+m^2}$.

This point being on (3), we must have on substituting x' and y' in (3), after reducing, $(a^2+b^2-c^2)(l^2+m^2)-2al-2bm+1=0$....(4). Making (4) homogeneous in l and m by means of (1) and arranging,

$$[x^2-2ax+(a^2+b^2-c^2)]\frac{l^2}{m^2}+2(xy-bx-ay)\frac{l}{m}+[y^2-2by+(a^2+b^2-c^2)]=0..$$

..(5), a quadratic in the parameter $\dfrac{l}{m}$, giving the envelope

$$c^2(x^2+y^2)=[(a^2+b^2-c^2)-by-ax]^2....(6).$$

Also solved by *P. S. BERG, G. B. M. ZERR* and the *PROPOSER*.

15. Proposed by CHARLES E. MYERS, Canton, Ohio.

From a given quantity of material a cylindrical cup with circular bottom and open top is to be made, the cup to contain the greatest amount. What must be its dimensions?

Solution by F. P. MATZ, M. S., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Represent the radius of the base by x, and the altitude by y; then, obviously, $\pi x^2+2\pi xy=s$. $\therefore y=(s-\pi x^2)\div 2\pi x$.

Also, $V=\pi x^2y=\pi x^2\left(\dfrac{s-\pi x^2}{2\pi x}\right)$, $=$a maximum.

$$\therefore \frac{dV}{dx}=s-3\pi x^2=0. \ \therefore \ x=\sqrt{\left(\frac{s}{3\pi}\right)},=y.$$

Also solveu by *P. S. BERG*, *C. W. M. BLACK*, *J. H. DRUMMOND*, *A. HUME*, *P. H. PHILBRICK*, *H. C. WHITAKER*, *G. B. M. ZERR*, and the *PROPOSER*.

PROBLEMS.

20. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

$$\int_0^{\frac{1}{2}\pi}\surd[(1-e^2\cos^2\phi)(1-e^2\sin^2\phi)]d\phi=\text{what?}$$

21 Proposed by T. JOHN COLE, Columbus, Ohio.

In the equilateral triangle *ABC*, *AB* the base is 10 feet. With *B* as a center an arc is drawn from *C* to *A*; likewise with *A* as a center an arc is drawn from *C* to *B*. What is the volume of the solid generated by revolving the figure about the altitude of the triangle as an axis.

Solutions to these problems should be received on or before August 1st.

MECHANICS.

Conducted by B.F.FINKEL,Kidder, Missouri. All Contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

6. Proposed by THOMAS W. WRIGHT, M. A., Ph. D., Professor of Applied Mathematics and Physics, Union College, Schenectady, New York.

What is the effect of a charge between light and heavy cavalry, the light cavalry having the greater energy and the heavy the greater momentum?

Solution by P. H. PHILBRICK. C. E., Lake Charles, Louisiana.

Let M and V represent the mass and velocety repectively of the heavy cavalry and M_1 and V_1 the same of the light cavalry. Supposing the bodies to be inelastic and moving in opposite directions before impact and together after impact their common velocity after impact is, $V=\dfrac{MV-M_1V_1}{M+M_1}$ ....(1).

Since $MV>M_1V_1$ the heavy cavalry will overcome the lighter and carry it along at the above rate. The combined energy of the bodies is, $\frac{1}{2}MV^2+\frac{1}{2}M_1V_1^2$....(2). This measures the distructive effect of the charge.

7. Proposed by DE VOLSON WOOD, M. A., M. Sc., C. E., Professor of Engineering, Stevens Institute of Technology, Hoboken, New Jersey.

A hollow sphere filled with frictionless water rolls down a rough plane whose length is l and inclination θ; when half way down the water suddenly freezes and adheres to the sphere. Required the time of the decent.